Education Reform and Development, 2024, Volume 6, Issue 10
https://ojs.bbwpublisher.com/index.php/ERD
Online ISSN: 2652-5372
Print ISSN: 2652-5364

The Application, Challenges and Reflection of Generative Artificial Intelligence in the Field of Education

Juan Bai*

Beijing International Studies University, Beijing 100024, China

Corresponding author: Juan Bai, bjzzl@163.com

Abstract: The rapid development of Generative Artificial Intelligence technology has brought new opportunities to the field of education, giving rise to a large number of intelligent teaching applications and improving the quality and efficiency of teaching. However, the education industry has also encountered unprecedented challenges and tests, including new adjustments and changes in educational concepts, curriculum content, teaching methods, allocation of educational resources, educational evaluation systems, and teacher career transformation. These challenges urgently need to be faced and overcome by educators together. Therefore, while facing the heat of artificial intelligence technology, it is necessary to maintain rational thinking and reflect on some of the problems exposed in the application process of artificial intelligence, ensuring that artificial intelligence technology is applied reasonably and truly serving the essence and goals of education, achieving a dynamic balance between technology and humanistic education.

Keywords: Artificial intelligence; Personalized learning; Teaching methods; Educational resources; Data privacy

Online publication: October 25, 2024

1. Introduction

With the rapid development of technology, generative artificial intelligence technology has widely penetrated all aspects of social life, and the education field has also shown new vitality under its influence. The innovative application of generative artificial intelligence technology in the education sector not only greatly broadens the boundaries of teaching methods and significantly improves teaching efficiency but also makes it possible to tailor learning paths for each student and open up a new chapter of personalized education [1]. This article aims to explore in depth how artificial intelligence leads innovative trends in the field of education through specific practices and case studies, and how these innovative applications profoundly shape the future of education.

2. Innovative application of generative artificial intelligence in the field of education

2.1. Intelligent-assisted teaching system

An intelligent-assisted teaching system is an important product that combines artificial intelligence and cognitive science. This type of system can automatically analyze students' learning data through deep learning and big data processing technology, provide personalized learning suggestions and resource recommendations, and provide real-time answers to students' questions during the learning process, providing learning guidance and answering services. For example, teaching assistants based on intelligent auxiliary teaching systems can automatically generate exercise questions that meet students' learning needs according to their learning progress and grades, effectively improving students' learning efficiency. Meanwhile, intelligent auxiliary teaching systems can provide teachers with auxiliary teaching tools and resources, helping them better organize classroom teaching and improve teaching effectiveness. Common models on the market, such as Squirrel AI and New Oriental Intelligent Learning System, analyze students' learning habits, progress, and comprehension abilities to customize personalized learning paths for them. Through multiple learning tracking engines, a closed-loop process from evaluation to learning path planning is implemented to help students master knowledge more efficiently. In addition, there is the Owlfit platform, which mainly utilizes artificial intelligence technology to decompose complex topics into easy-to-understand explanations, and provides personalized learning paths and interactive learning tools.

2.2. Intelligent writing and grammar-checking tools

At present, common intelligent writing platforms at home and abroad include QuillBot, Grammarly, Iwrite, etc., which are mainly positioned for intelligent writing and personalized learning. These platforms are designed to improve students' writing and research skills and are suitable for single-word and grammar checking, sentence reconstruction, abstract extraction, topic judgment, proofreading, and modification in the writing process. The essence of these technologies is cloud-based writing assistants that use artificial intelligence technology to improve the quality of written communication, provide real-time feedback on grammar, spelling, punctuation and clarity, help students and teachers optimize writing skills, and improve writing quality.

2.3. Intelligent evaluation and feedback system

The intelligent evaluation and feedback system mainly uses natural language processing and image recognition, big data analysis, machine learning and other technologies to achieve automatic grading of homework and automatic grading of exams. It can provide students with quick learning feedback, such as the commonly used iFlytek exam system, FLTRP itest system, Duolingo English Test (DET), etc., all of which belong to this category. It demonstrates the potential of AI technology in the automatic grading of exams and written writing checks, improving the efficiency and fairness of exams and evaluations. This system makes the evaluation results more objective and fair, helps students discover their problems on time and adjust their learning strategies, provides students with a more efficient and personalized learning experience, and also provides comprehensive and accurate teaching support for teachers [2].

2.4. Personalized learning path planning

Artificial intelligence technology can develop personalized learning paths for each student through big data analysis. For example, online teaching platforms utilize artificial intelligence technology to recommend

suitable learning resources and courses for students based on their learning abilities, interests, and goals, helping them achieve efficient learning. The advantage of personalized learning path planning is that it cultivates learners' autonomous learning ability and improves their learning experience. However, teachers need to be transformed from traditional knowledge transmitters to guides and partners for learners, which puts higher demands on their professional competence and teaching experience [3].

2.5. Virtual experimental teaching system

The virtual experimental teaching system aims to provide students with a safer and more convenient experimental learning environment by simulating real experimental scenes. The virtual experimental teaching system has multiple advantages, such as fast construction speed, easy management, the ability to break through the limitations of time, location, and equipment quantity, allowing students to conduct experiments in a safer environment, reducing concerns about experimental operations, and improving freedom.

In addition, virtual experimental teaching systems can also assist traditional experimental teaching, such as the ANSYS Discovery Live platform, which is mainly suitable for teaching and research in fields such as engineering and physics. Virtual teaching based on real-time simulation can be used to demonstrate physical phenomena and processes in real-time and is applied in fields such as fluid mechanics, mechanical mechanics, thermodynamics, etc. In addition, the SimScale system is a virtual simulation platform based on computer-aided engineering (CAE), which can be used to simulate various engineering scenarios and is mainly suitable for design, analysis, and optimization in the engineering field. Different virtual teaching systems have their characteristics and are widely used in teaching and research in different disciplines, providing students with a richer, more intuitive, and convenient learning experience.

3. Facing the challenges of new technologies in the field of education

3.1. Faced with the reconstruction of educational concepts and goals

In the era of artificial intelligence, there is a greater emphasis on the comprehensive development of students. Simply acquiring knowledge is no longer the core competitiveness, but rather the overall development of students, including their physical and mental health, social skills, critical thinking, and other aspects. Education needs to pay more attention to the cultivation of "soft skills" such as innovative thinking, critical thinking, complex problem-solving ability, collaborative communication ability, and moral and ethical judgment. The goal of talent cultivation is more diversified and three-dimensional, and knowledge transmission is not the only goal of education. Secondly, future education will place greater emphasis on self-directed learning and innovation abilities, cultivating students' innovative thinking and practical skills through teaching methods such as project-based learning and inquiry-based learning, to adapt to the rapidly changing social environment. Thirdly, there is a greater emphasis on personalized learning and cultivation. Through personalized training programs, students are no longer made to be stereotyped, and their individuality and characteristics are highlighted.

3.2. Reform of course content and structure

In the era of artificial intelligence, course resources face the challenge of rapid iteration and deepening, and knowledge content needs to be constantly updated and enriched with the development of the new era. Each discipline faces the need for disciplinary integration and knowledge restructuring [4]. Therefore, it is necessary

to establish an "artificial intelligence+" curriculum system to promote cross-disciplinary integration and innovation of curriculum content. One is to carry out interdisciplinary integration, encourage interdisciplinary cooperation, set interdisciplinary course content, and cultivate students' comprehensive abilities and innovative thinking. The second is to modularize the course content, allowing students to choose modules that suit their interests and needs for personalized learning. The third is to establish a flexible credit system, encourage students to participate in research project internships and other activities, convert practical experience into credits, and improve students' practical and innovative abilities. The fourth is to strengthen practical teaching, increase experimental courses, and provide students with more practical opportunities and platforms. Enable students to master the course knowledge structure in practice.

3.3. Integration of teaching methods and technology

In the era of artificial intelligence, teaching methods are facing new challenges. Teachers are no longer just disseminators of knowledge but need to become mentors who guide students to actively learn and grow their personalities. This requires teachers to receive new skill training, learn to use artificial intelligence technology to assist teaching, and shift their teaching methods from knowledge imparting to guiding and supporting. On the other hand, while integrating technology and education, it is necessary to balance the use of technology and humanistic care. While using artificial intelligence technology to improve teaching efficiency, attention should be paid to students' emotional needs to prevent the loss of humanistic care caused by students' excessive dependence on technology.

3.4. Educational resource allocation and equity

The introduction of artificial intelligence technology may to some extent exacerbate the unequal distribution of educational resources. Advanced educational products and services are often accompanied by high costs, making it difficult for economically underdeveloped areas or resource-scarce schools to keep up with the trend. Research under the background of the epidemic has shown that the urban-rural gap in accessing and utilizing information technology education resources is more pronounced [5]. Therefore, the issue of the digital divide may be difficult to solve in the short term.

In order to solve this problem, in the long run, it is necessary for the government and all sectors of society to work together to narrow the "digital divide" between urban and rural areas and regions by investing in infrastructure construction, subsidizing underdeveloped areas, and ensuring that all students have the opportunity to access and benefit from artificial intelligence education.

3.5. Evaluation system and teaching quality monitoring

In terms of the evaluation system, although artificial intelligence technology provides a new perspective for teaching evaluation, machine evaluation may be too mechanical and ignore the value of non-quantitative factors such as individual differences and emotional communication. Therefore, it is necessary to implement a human-machine complementary evaluation mode, combining machine evaluation with manual evaluation and giving different evaluation weights.

In addition, when using big data for learning behavior and outcome analysis, it is necessary to balance data privacy protection and transparency, protect sensitive personal data, publicly disclose public data, and effectively achieve the goals of data use and outcome analysis.

3.6. Professional transformation and psychological construction of teachers

Artificial intelligence has brought new challenges to the professional development of teachers, who need to transform from a single knowledge transmitter to a diversified and comprehensive teaching designer and learning partner, which requires a lot of professional development training and support. In terms of teachers' psychological development, some teachers may be concerned about their value being replaced by artificial intelligence technology, leading to career anxiety and confusion [6]. Therefore, it is necessary to provide them with sufficient psychological counseling and career development planning.

3.7. Policies, regulations, and ethical considerations

In terms of policy and regulatory follow-up, the widespread application of artificial intelligence technology in the field of education calls for relevant policies and regulations to keep pace with the times to ensure the healthy development of technology. At present, China has issued the "Interim Measures for the Management of Generative Artificial Intelligence Services" to standardize the application of artificial intelligence, which has become the main regulation for promoting the healthy development and standardized application of generative artificial intelligence in China at this stage. Next, the focus of China's legislation on artificial intelligence will include data protection and privacy rights, algorithm fairness and transparency, artificial intelligence security and regulation, and intellectual property and achievement transformation.

In terms of educating artificial intelligence, it is also necessary to continuously cultivate students' ethical awareness of artificial intelligence, ensuring that artificial intelligence technology always serves the progress and well-being of human civilization.

4. Reflection on the application of generative artificial intelligence in the field of education

4.1. Data privacy is at risk

The use of artificial intelligence in the field of education involves collecting personal data and privacy information of teachers and students. In the process of using artificial intelligence technology, it is necessary to ensure the security and privacy of teacher and student information. Sensitive data should be anonymized to prevent personal privacy leakage after information leakage [7]. Schools and other educational institutions should establish strict data protection and privacy policies, and strengthen training and awareness of data privacy policies.

In the process of information collection and processing, the following principles should be noted:

(1) Legitimate collection: When collecting information from teachers and students, it is necessary to ensure legality and compliance, clearly inform the purpose and scope of the information, and obtain consent.

(2) Minimization principle: Collect only necessary information to avoid the risk of information leakage caused by excessive collection.

(3) Secure storage: The collected information should be stored in a secure and reliable system to ensure that it is not accessed or used by unauthorized personnel; At the same time, information should be backed up regularly to prevent information loss.

(4) Restricted use: The use of information should be limited to educational and teaching purposes only, and unauthorized use is strictly prohibited. It should not be disclosed, sold, or provided to others

without authorization.

At the same time, certain technological measures should be taken to strengthen information protection:

(1) Using a data leakage prevention system to achieve multi-faceted protection of information in the education industry, ensuring the confidentiality, integrity, and availability of data.

(2) Provide multiple encryption modes and comprehensive permission control functions for important systems to ensure that only authorized personnel can view and operate critical data of the system.

(3) Strengthen network security and data security work, timely discover security vulnerabilities and issue alerts; At the same time, reliable data auditing functions are provided to record terminal operation behavior and generate logs, facilitating overall risk assessment of the system.

4.2. Possible issues with interpersonal interaction and lack of social skills

As an independent category of technology, artificial intelligence may experience a lack of "emotion" and "empathy" when applied, which may limit teachers and students communication skills, experience sharing, skill development, and other aspects. If students rely too much on artificial intelligence, it may weaken their ability to interact and cooperate with others and become isolated or even indifferent in interpersonal communication. Therefore, it is necessary to balance the use of artificial intelligence with traditional interpersonal interaction teaching and improve students' personality development [8].

To cultivate students' sound personality and solve problems such as lack of social skills, we can try to start from the following aspects:

(1) Enhance offline communication and activities

Schools should regularly organize various offline activities, such as sports games, cultural festivals, club activities, etc., to provide students with opportunities for face-to-face communication. These activities can promote emotional exchange and communication cooperation among students. In addition, teamwork should also be encouraged. In the classroom and extracurricular activities, teachers should design more tasks and projects that require teamwork, so that students can learn to communicate, coordinate, and solve problems in the process of completing tasks, thereby enhancing their social skills.

(2) Enhance teachers' social education skills

Regularly provide social education training to teachers to enhance their ability to guide students in interpersonal interaction and social skills. The training content can include knowledge in communication skills, emotional management, teamwork, and other areas. In addition, teachers are encouraged to guide students to engage in interpersonal interactions in their daily teaching, setting an example for students through their own words and actions, and teaching them how to get along well with others.

(3) Cultivate students' self-awareness and reflective ability

Guide students to have a correct understanding of their interpersonal communication skills, help them form a correct self-awareness, and improve their social skills in a targeted manner. Encourage students to reflect and summarize their social behavior, analyze their performance and problems in interpersonal interactions, and continuously improve their social skills and interpersonal communication abilities.

4.3. The selection and adaptability of teaching content

Although artificial intelligence can provide personalized content based on students' learning abilities and interests, selecting appropriate teaching content still requires the participation and guidance of teachers [9]. Teachers should understand students' needs and backgrounds, and choose teaching content that is suitable for their learning stage and interests. Teachers conduct personalized evaluations of students' knowledge levels, learning styles, and interests through communication and observation with them. Based on understanding students' interests, teachers can guide them to explore learning content related to their interests and supplement the parts that may be overlooked in the AI-recommended content. Apart from subject knowledge. Teachers should also focus on cultivating students' soft skills, such as critical thinking, innovative thinking, communication skills, and teamwork spirit.

4.4. Further consideration is needed for the correct use of technical tools

Teachers need to understand and be familiar with the intelligent technology tools they use to ensure their correct operation and use. Artificial intelligence technology tools should have ease of operation and user-friendliness to reduce learning costs for teachers and students. Before using artificial intelligence tools, encourage students to familiarize themselves with their functions and features, and understand in what scenarios they can be most effective, which can help avoid misuse or inefficient use. In addition, teachers should clarify the purpose and expected outcomes of using artificial intelligence tools to select appropriate tools and develop corresponding usage strategies [10]. In the process of using technological tools, the usage strategy of artificial intelligence tools can be adjusted according to actual effects to maintain the latest status of artificial intelligence tools. For teachers, the effectiveness and teaching effectiveness of technical tools should be regularly evaluated, and their usage methods should be promptly revised.

4.5. The moral and social impact generated by technological tools

The use of artificial intelligence technology should comply with ethical and legal requirements, and not infringe upon the rights and human rights of teachers and students. Teaching administrators should pay attention to the social impact of artificial intelligence technology, avoid potential discrimination and bias issues, strictly enforce laws and regulations on privacy and data security in use, and ensure that artificial intelligence systems comply with relevant privacy protection standards when processing personal data. Teaching managers should actively participate in the formulation and discussion of relevant artificial intelligence policies, and promote the establishment of reasonable technical supervision and management mechanisms.

In addition, when establishing supervision and feedback mechanisms, continuous monitoring of the operation of artificial intelligence systems should be carried out to ensure that they comply with ethical and legal requirements throughout their entire lifecycle, improve system transparency and interpretability, and enable students and parents to strengthen supervision and improvement of artificial intelligence systems. Regulatory agencies or departments can be established within the education system to oversee whether the use of artificial intelligence systems complies with ethical and legal requirements. At the same time, establish convenient channels for complaints and reports, and encourage the public to report artificial intelligence systems that violate ethics and laws.

4.6. Considerations on educational equity and popularization

To ensure the fairness and accessibility of education, and to address issues such as uneven distribution of educational resources and information asymmetry, we can narrow the education gap caused by regional and economic disparities by providing distance education and online courses. At the same time, optimize the allocation of educational resources to ensure efficient utilization of resources. For policymakers, by collecting and analyzing educational data, managers can gain a more accurate understanding of the current state of educational equity and develop targeted policies accordingly. In terms of teacher training and resource sharing, artificial intelligence technology can make it easier for teachers to access high-quality teaching resources and participate in online training. Collaboration and communication among teachers have become easier, which helps to improve the overall quality of education. Meanwhile, artificial intelligence can provide teaching strategy optimization suggestions for teachers by analyzing students' learning data.

4.7. Balance between personalization and standardization

Artificial intelligence technology can help achieve personalized education, but it also needs to consider the need for standardized education to ensure that the quality of education meets standards. Firstly, it is necessary to clarify educational goals and standards, set clear teaching objectives, ensure that basic teaching activities revolve around these goals, and ensure the directionality and consistency of teaching. Secondly, certain teaching standards should be established. While carrying out personalized teaching, teaching managers can establish certain teaching standards and evaluation systems to ensure the comparability of teaching quality and student learning outcomes. These standards can include curriculum outlines, teaching requirements, evaluation methods, etc.

In promoting the integration of personalization and standardization, schools should strengthen the training and guidance of teachers, ensure that they master corresponding teaching methods and skills, and maintain certain teaching norms and standards in personalized teaching. The school establishes a teaching supervision and evaluation mechanism to promptly identify and correct problems in teaching, and maintain the high quality of the teaching process. At the same time, data analysis can be used to optimize teaching, utilizing the data analysis capabilities provided by AI technology to conduct in-depth mining and analysis of students' learning data. Through the results of data analysis, students' learning status and needs can be more accurately understood, further optimizing the teaching process and methods. Again, in the teaching process, strengthen teacher-student interaction and communication, and provide targeted guidance and assistance to students.

5. Conclusion

The widespread application of generative artificial intelligence in the field of education has greatly enriched teaching methods, achieved personalized learning path customization, and improved teaching efficiency and interactivity. Through intelligent analysis of student learning data, teaching platforms can accurately push learning resources and assist in individualized teaching. However, the rapid development of generative artificial intelligence technology in the field of education is also accompanied by a series of problems that require profound reflection, such as data privacy protection issues, which can easily lead to the abuse or misuse of teacher-student information. The intensification of the technological divide may widen the inequality of educational resources. Excessive reliance on technology may weaken the cultivation of students' critical thinking and interpersonal communication skills. Therefore, while promoting the application of artificial

intelligence in education, it is necessary to establish and improve regulatory mechanisms, pay attention to ethical and moral construction, balance the relationship between technology and humanistic education, promote comprehensive human development, and ensure that technology truly serves the essence and purpose of education.

Funding

General Project of Beijing Higher Education Association in 2023, "Research on Artificial Intelligence Technology Leading the Construction and Application of Smart Campus in Colleges and Universities" (Project No.: MS2023140)

References

[1] Hu Y, Nie Q, Gu X, 2021, From Fair Opportunities to Fair Development: A Comparative Analysis of Large-Scale Online Education in Primary and Secondary Schools Between Urban and Rural Areas in China Under the Epidemic. China Distance Education, 2021(5): 13–27.

[2] Yang P, Xu Y, 2017, Digital Divide and Unequal Investment in Family Education. Peking University Education Review, 15(4): 126–154.

[3] Yang X, Shen S, 2019, A New Interpretation of the Relationship Between Teachers and Artificial Intelligence Technology: From the Perspective of "Human Structure" in Phenomenology of Technology. Research on Electronic Education, 40(5): 12–17.

[4] Yu H, 2020, The Value Dilemma and Breakthrough Path of Artificial Intelligence Education. Journal of Education Science, Hunan Normal University, 19(4): 56–62.

[5] Cao P, 2018, Smart Education: Educational Transformation in the Era of Artificial Intelligence. Education Research, 39(8): 121–128.

[6] Hu W, 2019, The Role Dilemma and Action Strategy of Teachers in the Era of Artificial Intelligence. Modern University Education, 2019(5): 79–84.

[7] Li H, Wang W, 2018, Intelligent Adaptive Learning Mode Supported by Artificial Intelligence. China Electronic Education, 2018(12): 88–95.

[8] Song L, Xu L, 2019, The Logical Starting Point and Boundary of Artificial Intelligence Education Application: Taking Knowledge Learning as an Example. China Electronic Education, 2019(6): 14–20.

[9] Yu L, Wei H, Gong X, 2020, On Learning Methods and Characteristics of Learning Resources in the Era of Artificial Intelligence. Research on Electronic Education, 41(4): 28–34.

[10] Liu L, Liu R, 2020, The Transformation of Teachers' Roles in the Era of Artificial Intelligence: Dilemma and Breakthrough—Based on Heidegger's Philosophy of Technology Perspective. Open Education Research, 26(3): 44–50.